CLAIMS

WHAT IS CLAIMED IS:

1. A method for establishing a protection path for a failed link between first and second nodes in a mesh network, wherein a transfer of information from the first node to the second node is disrupted by the failed link, the method comprising:

establishing an alternate path from the second node to the first node via a destination-to-source communication channel, wherein the destination-to-source communication channel is established through one or more alternate nodes beginning at the second node and ending at the first node;

executing a switch function at each of the alternate nodes traversed by the destination-to-source communication channel to allow source-to-destination information traffic flow from the first node to the second node along the alternate path defined by the destination-to-source communication channel; and

switching the information traffic flow at the first node from the failed link to the alternate path when the destination-to-source communication channel is established at the first node.

2. The method as in Claim 1, wherein the mesh network is an optical mesh network, and the information transferred comprises optical signals.

3. The method as in Claim 2, wherein the optical mesh network is an optical mesh network incorporating wavelength division multiplexing whereby multiple optical signals each transmitted at a different wavelength are transmitted on a single optical fiber.

4. The method of Claim 3, wherein executing a switch function comprises optically switching the wavelengths of one or more of the optical signals of the failed link onto optical fibers establishing the alternate path.

5. The method of Claim 4, wherein optically switching one or more of the optical signals of the failed link comprises switching the one or more optical signals to alternate ports of an optical cross-connect.

6. The method of Claim 3, wherein executing a switch function comprises switching the optical signals of failed optical fibers onto alternate optical fibers to establish the alternate path.

7. The method of Claim 6, wherein switching one or more of the optical signals of the failed fibers onto alternate optical fibers comprises collectively switching the one or more optical signals associated with the optical fibers of the failed link to different ports of a fiber cross-connect.

8. The method of Claim 1, wherein establishing an alternate path from the second node to the first node comprises routing the destination-to-source communication channel along a predetermined path of the alternate nodes.

9. The method of Claim 1, wherein establishing an alternate path from the second node to the first node comprises routing the destination-to-source communication channel along a dynamically-generated path of the alternate nodes.

10. The method of Claim 9, wherein routing the destination-to-source communication channel along a dynamically-generated path comprises monitoring a node status associated with potential alternate nodes, and selecting the potential alternate node for inclusion into the dynamically-generated path if its respective node status exhibits a predefined capacity of available information bandwidth.

11. The method of Claim 10, wherein monitoring a node status comprises monitoring a node address table of which the node status is a field thereof.

12. The method of Claim 11, wherein monitoring a node address table comprises monitoring the node status of at least the next two hops of nodes.

13. The method of Claim 1, further comprising detecting the failed link at the second node.

14. The method of Claim 13, wherein detecting the failed link comprises monitoring for a loss of optical power at a corresponding port of the node, and detecting the failed link when the optical power reaches a predetermined threshold.

15. The method of Claim 1, wherein the first node is an information-originating source node from which the information transfer is initiated.

16. The method of Claim 1, wherein the first node is an intermediate source node between the failed link and an information-originating source node from which the information transfer is initiated.

17. The method of Claim 1, wherein the second node is a targeted destination node to which the information transfer is ultimately directed.

18. The method of Claim 1, wherein the second node is an intermediate source node between the failed link and a targeted destination node to which the information transfer is ultimately directed.

19. The method of Claim 1, further comprising transmitting a failure notification message from the second node to the first node via the destination-to-source communication channel, wherein the destination-to-source communication channel transmits the failure notification message from the second node to the first node by way of the alternate path.

20. The method of Claim 19, wherein switching the optical traffic flow at the first node comprises switching the information traffic flow to the alternate path when the first node receives the failure notification message, thereby allowing the disrupted transfer of information to be switched to the alternate path when the first node is apprised of the failed link.

21. The method of Claim 1, wherein the destination-to-source communication channel comprises one or more wavelengths dedicated to transmitting management information, including a link failure notification.

22. A network protection configuration for use in optical mesh network topologies to reroute optical signals from a failed transmission path to one or more alternate transmission paths, the network protection configuration comprising:

an optical fiber network comprising a plurality of optical network nodes each coupled to transmit and receive optical signals carried on distinct wavelengths on optical fibers of the optical fiber network, the optical network further comprising a source node attempting to transmit the optical signals via the failed transmission path and a destination node detecting the failed transmission path; and

a communication channel established from the destination node to the source node to transmit a path failure notification, wherein a route established by the destination-to-source communication channel traversing one or more of the optical network nodes defines the alternate transmission path, and wherein the network nodes defining the alternate transmission path are switched in response to the path failure notification to facilitate source-to-destination transmission of the optical signals from the failed transmission path along the alternate path.

23. The network protection configuration as in Claim 22, wherein each of the optical network nodes further comprises memory to store an optical node address table, wherein the optical node address table maintains status information for surrounding optical network nodes being within at least two hops of the optical network node.

24. The network protection configuration as in Claim 23, wherein the status information comprises an optical node address for the surrounding optical network nodes.

25. The network protection configuration as in Claim 23, wherein the status information comprises node availability information for the surrounding optical network nodes.

26. The network protection configuration as in Claim 23, wherein the status information comprises node bandwidth capacity information for the surrounding optical network nodes.

27. The network protection configuration as in Claim 22, wherein each of the optical network nodes further comprises a fiber cross-connect circuit coupled to one or more of the optical fibers of the failed transmission path to switch the optical signals corresponding to a failed optical fiber to fiber cross-connect output ports to route the optical signals corresponding to the failed optical fiber to targeted optical fibers along the alternate path.

28. The network protection configuration as in Claim 27, wherein each of the optical network nodes further comprises an optical cross-connect circuit coupled to the fiber cross-connect circuit to switch at least one of the optical signals corresponding to the failed transmission to optical cross-connect output ports to route the at least one optical signal to targeted fibers in the fiber cross-connect for ultimate transmission along the alternate path.

29. The network protection configuration as in Claim 22, wherein the optical fiber network incorporates wavelength division multiplexing whereby multiple optical signals each transmitted at a different wavelength are transmitted on a single fiber.

30. The network protection configuration as in Claim 22, further comprising monitoring means for detecting the failed transmission path at the destination node.

31. The network protection configuration as in Claim 22, wherein each of the optical network nodes comprises switching means for rerouting the optical signals corresponding to the failed transmission to optical fibers along the alternate path in response to the path failure notification.

32. A network protection configuration for use in optical mesh network topologies to reroute optical signals from a failed transmission path to one or more alternate transmission paths, the network protection configuration comprising:

an optical fiber network comprising a plurality of optical network nodes each coupled to transmit and receive optical signals carried on distinct wavelengths on optical fibers of the optical fiber network, each of the plurality of optical network nodes comprising:

a fiber cross-connect circuit coupled to receive one or more of the optical fibers of the optical fiber network and to switch the optical signals on the optical fibers to particular output ports of the fiber cross-connect to route the optical signals on the optical fibers to targeted optical fibers;

an optical cross-connect circuit coupled to receive one or more of the optical signals and to switch the optical signals to particular output ports of the optical cross-connect to route the optical signals to targeted ones of the optical fibers;

a destination-to-source communication channel established from a destination node detecting the failed transmission path to a source node to transmit a failed path notification, wherein a route established by the destination-to-source communication channel traversing one or more of the optical network nodes defines the alternate transmission path, and wherein the fiber cross-connect and optical cross-connect circuits of the network nodes defining the alternate transmission path are switched in response to the failed path notification to facilitate source-to-

destination transmission of the optical signals from the failed transmission path along the alternate path.

33. A method for establishing a protection path for a failed optical link between a source node and a destination node in an optical WDM mesh network, wherein a transfer of optical signals from the source node to the destination node is suspended by the failed optical link, the method comprising:

detecting the failed optical link at the destination node by recognizing the loss of optical power at destination node cross-connect ports;

transmitting a link failure signal via a communication channel from the destination node detecting the failed link to the source node through one or more alternate nodes;

configuring a cross-connect switch at each of the alternate nodes receiving the link failure signal, comprising cross-connecting input ports to output ports of the cross-connect switch such that a source-to-destination protection path for transmission of the suspended optical signals is established as the link failure signal is transmitted from the destination node to the source node; and

switching the suspended optical signals from the failed optical link to the source-to-destination protection path upon receipt of the link failure signal at the source node, whereby the source-to-destination protection path is set up using a destination-to-source communication channel.